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Holistic analysis of hepatosteatosis literature: a scientometric study of global hepatosteatosis publications between 1980 and 2019

Hepatosteatoz literatürün bütünsel analizi: 1980 ve 2019 arasındaki küresel hepatosteatoz yayınlarının scientometrik çalışması

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ABSTRACT

Aim: Hepatosteatosis is a subtype of Non-Alcoholic Fatty Liver Disease (NAFLD) with an increased significance and prevalence in recent years, progressing to chronic liver disease and even hepatocellular carcinoma. It has become the new focus of hepatology instead of viral hepatitis in the last 5 years because of its increasing prevalence and close association with metabolic diseases such as obesity, diabetes and hyperlipidemia. The present study aimed to make a holistic scientometric analysis of scientific studies conducted on hepatosteatosis.

Material and Method: We analyzed scientometric analysis of "hepatosteatosis" publications that were indexed in Web of Science databases between 1980 and 2019 and found a total of 996 articles.

Results: The most published documents were original articles (80.924%). The most investigated areas in the hepatosteatosis literature were found to be gastroenterology, biochemistry and endocrinology (n=751, 687 and 575 documents, respectively). The USA was the leading country with 371 articles, followed by Turkey, China, Japan, Italy and Germany (n=146, 145, 81 and 58 articles, respectively). Zhang Yen was found to be the most productive author from Yanbian University (China) and California University was the most productive institution. The hepatosteatosis literature H-index was measured as 76, with an average of 24.8 citations per item and a total of 24.705 citations. The most indexed keywords were found to be "hepatosteatosis", "fatty liver", "obesity" and "insulin resistance". The USA, China, UK, Germany and Italy were found to be the most cooperating countries.

Conclusion: Hepatosteatosis is an issue with increased importance and popularity with the intense interest of researchers in the past few years. The data of the present study, in which the scientometric analysis of the studies on hepatosteatosis was performed, emphasized the importance of the subject once again and will guide researchers for new researches to be conducted on many subjects such as which countries, institutions, individuals and journals are more interested in hepatosteatosis, and in which areas the studies are concentrated. To the best of our knowledge, it is the first scientometric study evaluating hepatosteatosis.

Keywords: Hepatosteatosis, holistik analisis, metabolic disorders, scientometric

ÖZ

Amaç: Hepatosteatoz, son yıllarda önemi ve prevalansı artan, kronik karaciğer hastalığına ve hatta hepatosellüler karsinomaya ilerleyen Alkolsüz Yağlı Karaciğer Hastalığı'nın (NAFLD) bir alt tipidir. Artan prevalansı ve obezite, diyabet, hiperlipidemi gibi metabolik hastalıklarla yakın ilişkisi nedeniyle son 5 yılda viral hepatit yerine hepatolojinin yeni odağı haline gelmiştir. Bu çalışma, hepatosteatoz ile ilgili yapılan bilimsel çalışmaların bütüncül bir scientometrik analizini yapmayı amaçlamıştır.

Gereç ve Yöntem: 1980 ile 2019 yılları arasında Web of Science veri tabanlarında indekslenen "hepatosteatoz" yayınlarının scientometrik analizini inceledik ve toplam 996 makale bulduk.

Bulgular: En çok yayınlanan dökümanlar orijinal makalelerdi (%80,924). Hepatosteatoz literatüründe en çok araştırılan alanların gastroenteroloji, biyokimya ve endokrinoloji olduğu bulundu (sırasıyla n=751, 687 ve 575 döküman). ABD 371 makale ile lider ülke olurken, onu Türkiye, Çin, Japonya, İtalya ve Almanya takip etti (sırasıyla n=146, 145, 81 ve 58 makale). Zhang Yen'in Yanbian Üniversitesi'nden (Çin) en üretken yazar olduğu ve California Üniversitesi'nin en üretken kurum olduğu tespit edildi. Hepatosteatoz literatür H-indeksi madde başına ortalama 24,8 ve toplam 24.705 atıf ile 76 olarak ölçüldü. En çok indekslenen anahtar kelimelerin "hepatosteatoz", "yağlı karaciğer", "obezite" ve "insülin direnci" olduğu bulundu. ABD, Çin, İngiltere, Almanya ve İtalya en çok işbirliği yapılan ülkeler olarak belirlendi.

Sonuç: Hepatosteatoz, son birkaç yıldır araştırmacıların yoğun ilgi göstermesi ile birlikte önemi ve popülaritesi artmış bir konudur. Hepatosteatoz üzerine yapılan araştırmaların scientometrik analizinin yapıldığı bu çalışmanın verileri, konunun önemini bir kez daha vurgulamış ve hepatosteatoz ile hangi ülke, kurum, kişi ve dergilerin daha çok ilgilendikleri ve araştırmaların hangi alanlarda yoğunlaştığı gibi pek çok konuda araştırmacılara yapılacak yeni araştırmalar için yol gösterici olacaktır. Bildiğimiz kadarıyla da hepatosteatozu değerlendiren ilk scientometric çalışmadır.

Anahtar Kelimeler: Hepatosteatozis, bütünsel analiz, metabolik bozukluklar, scientometrik

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INTRODUCTION

Hepatosteatosis is a pathological condition in which there is an accumulation of triglycerides in hepatocytes (1-3). When it occurs in the absence of excessive alcohol consumption, it is called non-alcoholic fatty liver disease (NAFLD). It is known that hepatosteatosis is extremely common in obese and diabetic patients (4-6). The prevalence of hepatosteatosis is increasing rapidly worldwide due to the rapid increase in obesity and obesity-related comorbidities. The worldwide prevalence of hepatosteatosis is estimated to be as high as 1 billion and is the most common cause of chronic liver disease in the United States. Hepatosteatosis is usually asymptomatic but is the most common cause of elevated liver enzymes (4,7-9). Generally, the clinical history of the patients includes alcohol use, drugs, diabetes mellitus (DM), obesity, pregnancy and elevated liver enzymes. Liver ultrasound is an easy way to detect hepatosteatosis (4,10). The most important approach for the treatment of hepatosteatosis is treatments for the causes of hepatosteatosis.

Until 5 years ago, viral hepatitis (B and C) constituted an important part of clinical research in the field of hepatology. Thanks to the development of therapies that suppress hepatitis B virus replication and highly effective antivirals, almost all patients are cured of hepatitis C virus infection and their complete eradication is expected in the very near future (11). Therefore, the focus of hepatology has recently changed to hepatosteatosis and non-alcoholic steatohepatitis (NASH).

Scientometrics is a statistical field investigating academic literature in a certain area (12). Although it has been a popular and trending scientific method of analyzing academic publications, the medical corpus lacks a holistic scientometric study evaluating hepatosteatosis literature.

In this study, we aimed to evaluate the scientometric features of the hepatosteatosis literature covering the 1980-2019 period.

MATERIAL AND METHOD

Ethics committee approval was not required for the preparation of the article.

All data analyzed in our study were collected by using Web of Science (WoS, Clarivate Analytics) databases. The keyword of "hepatosteatosis" was used for our basic search. All documents produced between 1980 and 2019 were included in the scientometric assessment. GunnMap 2 free web source was used for creating an info-map revealing country distribution of the global production of the hepatosteatosis literature (13). We created scientometric networks for keywords and institutions in VoSviewer software (14). Ethics committee approval was not required for the preparation of the article. Institutional approval was obtained for the preparation of the article. All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

RESULTS

General Features of Hepatosteatosis Literature

A total of 996 indexed articles were found between 1980 and 2019 in WoS databases. Original articles covered 80.924% of all literature followed by proceeding papers, reviews, and case reports (339, 74, and 22 items, respectively; **Table 1**). The most studied areas in hepatosteatosis literature were Gastroenterology, Biochemistry, and Endocrinology (n=751, 687, and 575 documents, respectively; **Table 1**).

Productivity of Countries, Authors, Source Titles, and Institutions

The USA was the leading country with 371 articles followed by Turkey, China, Japan, Italy, and Germany (n=146, 145, 81, and 58 papers, respectively; **Figure 1**). The global distribution map of productivity revealed irregularity and most countries in Africa and Central Asia had no contribution to the literature (**Figure 2**). Zhang Y from Yanbian University (China) was found as the most prolific author and the University of California was the most productive institution (**Table 1**). Six of the top ten foundations were from the USA and China was the only developing country according to the most contributor institutions (**Table 1**). The most productive source titles in the literature were Diabetes, PLOS One, and Hepatology (4.317, 3.715, and 3.614%, respectively; **Table 1**).

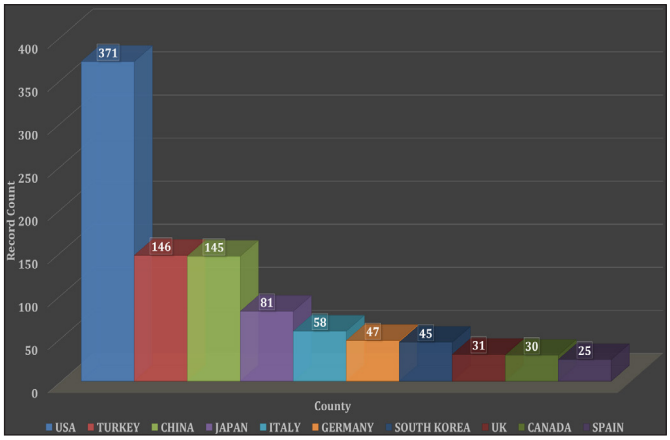

Figure 1. Top ten countries producing documents in hepatosteatosis area by total record count

Table 1. Top ten document types, research areas, source titles, authors, and organizations in hepatosteatosis literature [a]

			Record count	% a
Document Type				
Original Article			806	80.924
Meeting Document (Abstract)			180	18.072
Meeting Document (Full Text)			159	15.964
Review			74	7.430
Case Report			22	2.209
Letter			13	1.305
Editorial Material			12	1.205
Correction			5	0.502
Book			3	0.301
Others			460	46.185
Research Area				
Gastroenterology			751	75.402
Biochemistry			687	68.976
Endocrinology			575	57.731
Genetics			510	51.205
Nutrition			497	49.900
Pathology			337	33.835
Cell Biology			336	33.735
Pharmacology			312	31.325
Physiology			203	20.382
Immunology			192	19.277
Journal Name				
Diabetes			43	4.317
PLOS One			37	3.715
Hepatology			36	3.614
FASEB Journal			29	2.912
Journal of Hepatology			23	2.309
Journal of Lipid Research			21	2.108
Journal of Biological Chemistry			19	1.908
Diabetologia			15	1.506
Endocrinology			15	1.506
Cell Metabolism			14	1.406
Author	**Institution**	**Country**		
Zhang Y	Yanbian University	China	13	1.305
Gonzalez FJ	National Institutes of Health	USA	12	1.205
Hines IN	East Carolina University	USA	11	1.104
Li Y	Guangxi University	China	10	1.004
Kahn CR	Harvard Medical School	USA	9	0.904
Sajan MP	University of South Florida	USA	9	0.904
Shimano H	University of Tsukuba	Japan	9	0.904
Wheeler MD	East Carolina University	USA	9	0.904
Farese RV	University of South Florida	USA	8	0.803
Hussain MM	Winthrop University	USA	8	0.803
Organizations		**Country**		
University of California System		USA	36	3.614
Harvard University		USA	30	3.012
National Institutes of Health		USA	26	2.610
University of Texas System		USA	23	2.309
University of North Carolina		USA	20	2.008
Chinese Academy of Sciences		China	17	1.707
Centro de Investigación Biomédica en Red		Spain	17	1.707
Institut National de la Santé et de la Recherche Médicale		France	17	1.707
Shanghai Jiao Tong University		China	15	1.506
University Of North Carolina		USA	15	1.506
Total			996	100

[a]Total percentage may exceed 100% because certain items were included in more than one category.

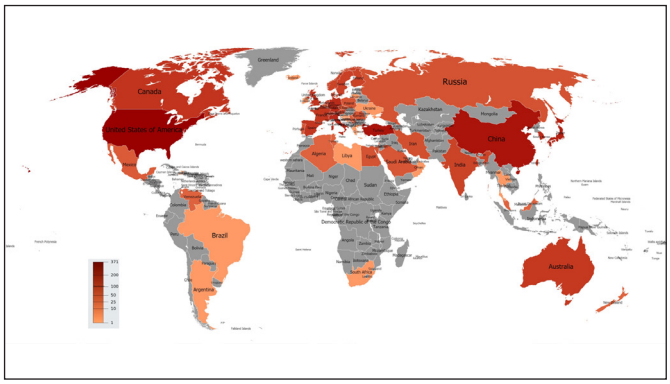

Figure 2. Global distribution of the productivity in hepatosteatosis literature

Citation Analysis

The h-index of hepatosteatosis literature was measured as 76. Average citations per item were 24.8 and the total number of citations was 24,705 (24,184 without self-citations). Starting year of citations was 1986 with one record. The peak year was 2019 with 4003 citations. The most cited document was an original article titled "Identification of a lipokine, a lipid hormone linking adipose tissue to systemic metabolism" by Cao et al. published in 2008 in the journal Cell.

Scientometric Networks Analyses

A scientometric network map of the most indexed keywords revealed a flower pattern in which the keywords of "hepatosteatosis", "fatty liver", "obesity" and "insulin resistance" were centered (**Figure 3**). The most used keywords were detected to be "hepatosteatosis", "obesity", "insulin resistance", "non-alcoholic fatty liver disease" and "fatty liver" (**Table 3**). The most collaborative institutions were the Chinese Academy of Sciences, Shanghai Jiao Tong University, and Harvard University (total link strength= 20, 17, and 15, respectively, **Figure 4**). The USA, China, the UK, Germany, and Italy were the most cooperative countries according to the scientometrics network (total link strength= 202, 96, 55, 47, and 43, respectively; **Figure 5**).

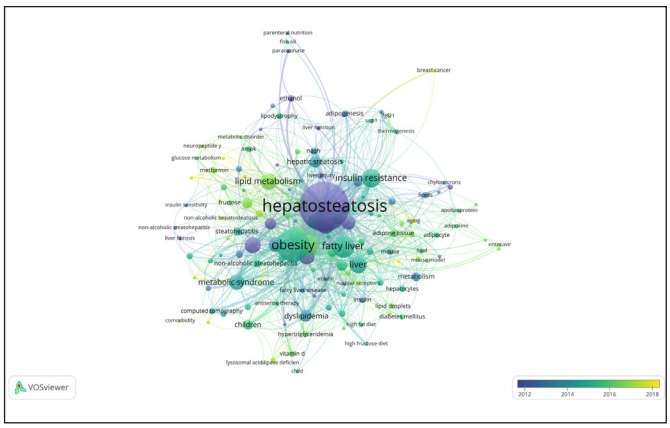

Figure 3. Scientometric network of the most used keywords in hepatosteatosis literature

Table 2. The ten most-cited manuscripts by time periods on hepatosteatosis

Article	Author	Journal name/published	Total citation	Average citations per year
Identification of a lipokine, a lipid hormone linking adipose tissue to systemic metabolism	Cao, Haiming; Gerhold, Kristin; Mayers, Jared R.; et al.	Cell	677	52.08
Fibroblast Growth Factor 21 Corrects Obesity in Mice	Coskun, Tamer; Bina, Holly A.; Schneider, Michael A.; et al.	Endocrinology	667	51.31
Endoplasmic reticulum stress in liver disease	Malhi, Harmeet; Kaufman, Randal J.	Journal of Hepatology	655	65.50
Essential metabolic, anti-inflammatory, and anti-tumorigenic functions of miR-122 in liver	Hsu, Shu-hao; Wang, Bo; Kota, Janaiah; et al.	Journal of Clinical Investigation	475	52.78
Adipocyte-derived Th2 cytokines and myeloid PPAR delta regulate macrophage polarization and insulin sensitivity	Kang, Kihwa; Reilly, Shannon M.; Karabacak, Volkan; et al.	Cell Metabolism	466	35.85
Impaired regulation of hepatic glucose production in mice lacking the forkhead transcription factor foxo1 in liver	Matsumoto, Michihiro; Pocai, Alessandro; Rossetti, Luciano; et al.	Cell Metabolism	376	26.86
Crucial role of a long-chain fatty acid elongase, Elovl6, in obesity-induced insulin resistance	Matsuzaka, Takashi; Shimano, Hitoshi; Yahagi, Naoya; et al.	Obesity	330	23.57
Cafeteria Diet Is a Robust Model of Human Metabolic Syndrome with Liver and Adipose Inflammation: Comparison to High-Fat Diet	Sampey, Brante P.; Vanhoose, Amanda M.; Winfield, Helena M.; et al.	Obesity	296	29.60
Dephosphorylation of translation initiation factor 2 alpha enhances glucose tolerance and attenuates hepatosteatosis in mice	Oyadomari, Seiichi; Harding, Heather P.; Zhang, Yuhong; et al.	Cell Metabolism	291	22.38
Adipocytokines in obesity and metabolic disease	Cao, Haiming	Journal of Endocrinology	282	40.29

Table 3. Most used 20 keywords by decades in the literature related to hepatosteatosis literature

Keyword (Total link strength)
1. Hepatosteatosis (279)
2. Obesity (191)
3. Insulin resistance (92)
4. Non-alcoholic fatty liver disease (81)
5. Fatty liver (71)
6. Oxidative stress (71)
7. Metabolic syndrome (66)
8. Liver (65)
9. Diabetes (64)
10. Lipid metabolism (56)
11. Inflammation (52)
12. Type 2 diabetes (50)
13. Steatosis (49)
14. Dyslipidemia (47)
15. Fibrosis (43)
16. Lipogenesis (36)
17. Adiponectin (34)
18. Hepatic steatosis (33)
19. Mitochondria (32)
20. Atherosclerosis (29)

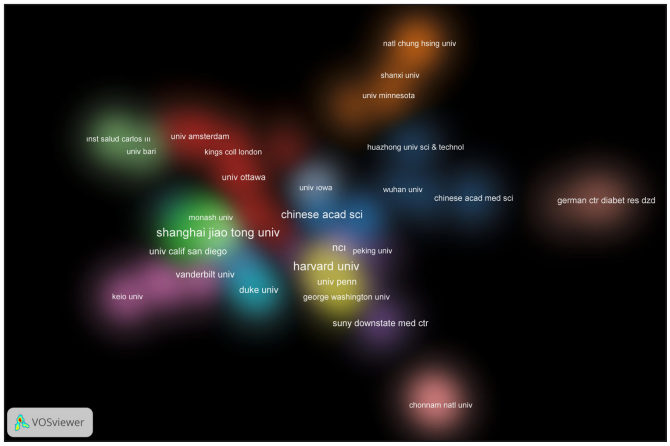

Figure 4. Scientometric network of the most collaborative countries in hepatosteatosis literature

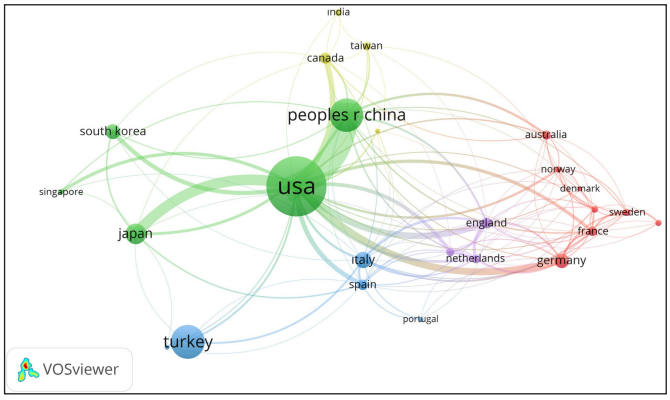

Figure 5. Scientometric network of the most collaborative institutions in hepatosteatosis literature

DISCUSSION

Although fatty liver had been known for many years, it has not been considered as a separate disease until 1980. An increasing number of studies have been conducted on hepatosteatosis since this date and the importance of hepatosteatosis was emphasized in these studies. Hepatosteatosis is among the subtypes of NAFLD. NAFLD is the fastest growing chronic liver disease with a worldwide prevalence of approximately 25%. Nearly 30% of NAFLD can lead to fibrosis, cirrhosis, liver failure and even hepatocellular carcinoma (15). Hepatosteatosis, which is a subtype of NAFLD, is known to be extremely common in obese patients and patients with diabetes. There is a significant increase in hepatosteatosis because of the significant increase in the prevalence of obesity and diabetes all over the world (4). It can be argued that the prevalence of hepatosteatosis will also increase in the future with the addition of sedentary lifestyles, which is among the important problems of our age, to these metabolic disorders. Although the main focus of hepatology was viral hepatitis (especially hepatitis B and C) until recent times, today, significant increases are reported in studies conducted on hepatosteatosis and NAFLD (16). According to the literature review conducted in the present study, it was found that only one scientometric study was conducted regarding NAFLD and NASH, but no scientometric studies have yet been conducted for hepatosteatosis. To the best of our knowledge, the present study will make a significant contribution to the literature and scientists because it is the first scientometric analysis to evaluate hepatosteatosis. This scientometric analysis can save researchers time by evaluating hepatosteatosis studies in the literature accurately and quickly, and guide researchers in future hepatosteatosis studies. The results of this study can help scientists on many issues, such as which keywords researchers will commonly use, which journals, institutions and countries will be most interested in hepatosteatosis studies.

The interest of researchers in hepatosteatosis studies began in the early 1980s and has continued to increase until our present day. Obesity and diabetes, which are major public health problems all over the world, are the leading causes of death and disability and are closely related to hepatosteatosis (4,17). The fact that hepatosteatosis is both significantly increased in prevalence and associated with important metabolic diseases may explain why researchers have recently been more interested in hepatosteatosis and the increase in the literature in this area. In the analysis in the present study, it was found that the United States of America (18), the country that has the highest obesity prevalence in the world, is by far the country with the highest contribution to the hepatosteatosis literature with 371 articles. No African country was in the top 10. The prominent country in Europe was Turkey, but it was China in Asia. When the keyword network was examined, it was seen that hepatosteatosis is associated with many metabolic disorders, especially "obesity", "fatty liver", "insulin resistance", and "lipid metabolism". These data emphasize the importance of hepatosteatosis. For hepatosteatosis, gastroenterology, biochemistry and endocrinology were the three most investigated fields and original articles constituted 80.92% of the studies. Diabetes was the journal that contributed the most to the literature with 43 articles. Although 7 out of the top 10 most prolific authors were from the United States, Zhang Y from Yanbian University (China) was found to be the most prolific author. Regarding the hepatosteatosis literature, the top 5 most productive institutions were also from the USA, with California System University being the most productive institution with 36 studies. Among the top 10 contributing institutions were 2 from China and 1 from Spain and France.

The most important limitation of the present study was that all analyzed data were collected by using only the Web of Science database. We think that there is a need for scientometric analysis of hepatosteatosis by scanning other databases along with Web of Science.

CONCLUSION

The results of the study clearly showed the relationship of hepatosteatosis with metabolic disorders such as obesity, diabetes and dyslipidemia, and the importance that scientists attached to this issue recently. The importance given to hepatosteatosis by scientists in the USA, which is one of the countries where obesity and diabetes are big problems, was among the prominent characteristics. We think that the data of the present study will guide other studies to be conducted on subjects such as which countries, institutions, individuals and journals are more interested in hepatosteatosis and in which areas the studies are concentrated.

ETHICAL DECLARATIONS

Ethics Committee Approval: Ethics committee approval was not required for the preparation of the article. Institutional approval was obtained for the preparation of the article.

Informed Consent: Since this study used an immortal cell line, infomed consent is not required.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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